

**INCIDENCE AND COSTS OF DEER-RELATED VEHICULAR
ACCIDENTS IN TOMPKINS COUNTY, NEW YORK:**

**INSIGHTS ON AN INCREASINGLY IMPORTANT
ASPECT OF DEER MANAGEMENT**

by

Daniel J. Decker, Kathlene M. Loconti Lee and Nancy A. Connelly

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ABSTRACT

Deer-related vehicular accidents (DRVAs) are a reality of human coexistence with deer. In 1988, a study was conducted in Tompkins County, New York to determine the incidence and costs of DRVAs, including those not reported to the New York State Department of Environmental Conservation (DEC). A combination of insurance agency records, DEC records, and telephone interviews was employed to estimate the incidence and cost of DRVAs in the county for 1988. We estimated 1,722 (± 532) DRVAs occurred, resulting in an estimated \$1.5 million of damage. Applying some assumptions described in the main report, we would estimate as a first approximation that 57,000 DRVAs occurred statewide in 1988, resulting in a property damage in the range of \$50 million. Implications for deer population management are discussed.

Keywords: Deer management, deer-related vehicular accidents, human dimensions, socioeconomics, survey research, white-tailed deer

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INTRODUCTION

Management of white-tailed deer (*Odocoileus virginianus*) requires the careful weighing of benefits and costs associated with this species. Among the costs deer managers consider are those associated with deer-related vehicular accidents (DRVAs). These are unique compared to other costs, such as damage to crops, forest regeneration and ornamental shrubs, in that DRVAs carry the potential for human injury and death. Wildlife managers have attempted to develop means to reduce the incidence of DRVAs (Reed et al. 1982), including special road signs to warn motorists (Williams 1964), roadside fencing (Feldhamer et al. 1986, Ludwig and Bremicker 1983), reflective and other optical devices to frighten deer from approaching highways (Gilbert 1982, Rudelstorfer and Schwab 1975, Schafer and Penland 1985, Zacks 1986), and intercept feeding strategies to keep deer off highways (Wood and Wolfe 1988). These methods may reduce the incidence of DRVAs in certain situations, but population management to control the density of deer in areas prone to DRVAs is the most pragmatic approach to limiting the probability of DRVAs.

In comprehensive deer population management, however, the societal benefit of reducing the probability of DRVAs needs to be weighed against the benefits of recreational hunting and deer observation (including seeing deer from the highway while driving). Thus, the prospect of low deer populations to limit DRVAs needs to be considered against the desirability of high deer populations to provide maximum sightings and harvest potential. Although motorists have not organized to express their opinions about the management of deer populations, managers should strive to

integrate a variety of stakeholder perspectives, not just those of organized interest groups, such as hunters and agriculturalists.

The deer population situation in New York in recent years has been marked by mixed reactions from various stakeholders. Managers occasionally have found themselves caught between hunters wanting moratoriums on antlerless deer harvest to increase populations, and farmers and residential landowners wanting greater harvests to decrease depredation on crops and ornamental plantings. At the same time, there is evidence that people have concerns about DRVAs (Decker and Gavin 1987, Connelly et al. 1988).

In the process of balancing the various and divergent stakeholders in the deer population, the New York State Department of Environmental Conservation (DEC) and the Human Dimensions Research Unit (HDRU) at Cornell have sought information about the wildlife acceptance capacities (Decker and Purdy 1988) of several key groups of stakeholders in management. Farmers' tolerance of deer damage to crops (Brown et al. 1978, Brown and Decker 1979, Decker and Brown 1982, Decker et al. 1984, Purdy et al. 1989), commercial nursery producers' tolerance of plant damage (Sayre and Decker 1989), residential landowners' tolerance of damage to ornamental plantings around their homes (Decker and Gavin 1987, Connelly et al. 1988, Sayre and Decker 1989), rural, nonfarm landowners' desires for deer population management (Purdy et al. 1989), deer hunters' preferences for deer population levels (Decker et al. 1983, Decker and Connelly 1988, Purdy et al. 1989), and nonhunting recreationists'

attitudes about sighting deer as part of their recreation experience (Smolka et al. 1986) have all been studied in recent years to provide deer managers with information for decision making.

A compelling reason to obtain information on DRVAs is that the potential for involvement in a DRVA makes anyone who operates or rides in a motor vehicle in areas inhabited by deer a stakeholder in deer management. Deer management, especially the need for deer population control, gains relevance for many people if couched in terms of probability of DRVAs, especially when the costs of such events are considered.

Managers who seek both biological and human dimensions information as input to deer management planning are likely to find DRVAs to be problematic in decision making. Despite the concern over DRVAs, and attempts to consider them in deer management programs, relatively little is known about them. Many states do not monitor the incidence or actual costs of DRVAs for deer management units. The only data often are regional biologists', technicians', and law enforcement officers' impressions of DRVA trends in their areas. Certainly the accuracy and specificity of information about DRVAs does not match other data available for deer population trends and harvest. There are many reasons for this situation, not the least of which is the logistical problem of obtaining reliable data, and the cost of doing so.

As a first step in understanding the incidence and costs of DRVAs in New York, the HDRU and the DEC collaborated on a pilot study in Tompkins County, New York.

The purpose was to estimate the incidence and costs of DRVAs for calendar year 1988. Besides the specific information about DRVAs obtained, the methods for obtaining data and the associated costs were examined with an eye toward statewide application. This paper reports the findings from the pilot study to provide a first approximation of the potential impact of DRVAs in New York.

LITERATURE REVIEW

Deer-car collisions have been studied previously to a limited degree. Typically, the incidence and costs of deer-car collisions along particular sections of highway have been documented (e.g., Wood and Wolfe 1988) or average costs of car accidents have been used in conjunction with records of reported deer-car collisions to estimate costs in a state or region (e.g., Gutos 1987). The only data available reflecting the number of deer-car accidents often are from records of road-killed deer. For example, Hansen and Wolfe (1983), National Safety Council (1984), and Pennsylvania Game Commission (1985) have reported highway deaths of deer in Michigan, New York and Pennsylvania, respectively. However, accidents in which a deer is struck but not killed or where a deer causes a motorist to have an accident but is not struck go unaccounted for in the statistics.

Cost estimates have been derived from mail surveys (Pils and Martin 1979, Hansen 1983), obtained from insurance company records (Arnold 1978, Goetz and Butterfield 1978, Wood and Wolfe 1988), and extrapolated from average highway accident figures prepared by the National Safety Council (Gutos 1987). Fairly disparate

figures have been reported among the most recent studies; property damage estimates (i.e., no personal injury included) have ranged from \$635 (Wood and Wolfe 1988) to \$1,600 (Gutos 1987) per accident. The incidence of human injury in deer-car collisions has been reported to be 4-5% (Arnold 1979, Hansen 1983), but costs associated with such injuries have not been well documented.

Studies on the seasonal characteristics of deer-car collisions have shown the incidence of accidents to peak in October-December, often accompanied by a less pronounced peak in March-May (Bellis and Graves 1971, Puglisi et al. 1974, Carbaugh et al. 1975, Allen and McCullough 1976, Pils and Martin 1979). Changes in deer activity are believed to be the cause for this seasonal variation (Reilly and Green 1974, Arnold 1978). Rut, food availability, and hunting are considered the largest factors in the fall peak; food availability is believed to be the important factor in the spring.

Allen and McCullough (1976:318) found the majority of accidents occur between 1600 and 0200h. Most collisions reportedly occur at sunset and 2-3 hours thereafter (Pils and Martin 1979, Langenau and Rabe 1987). Allen and McCullough (1976) noted that adoption of daylight savings time caused an increase in the number of deer-car collisions an hour earlier than without daylight savings time.

STUDY AREA

The study reported herein was conducted in Tompkins County, NY. Tompkins County is located in central New York, surrounding the south end of Cayuga Lake, one of the Finger Lakes (Fig. 1). The county occupies a land area of 1,276 km² (492.8 mi²), in the Appalachian Plateau physiographic area (Dickinson 1983). Approximately 306 km² are in agricultural production, 709 km² are forested, with the remainder primarily in some form of residential or commercial development. Deer have been observed

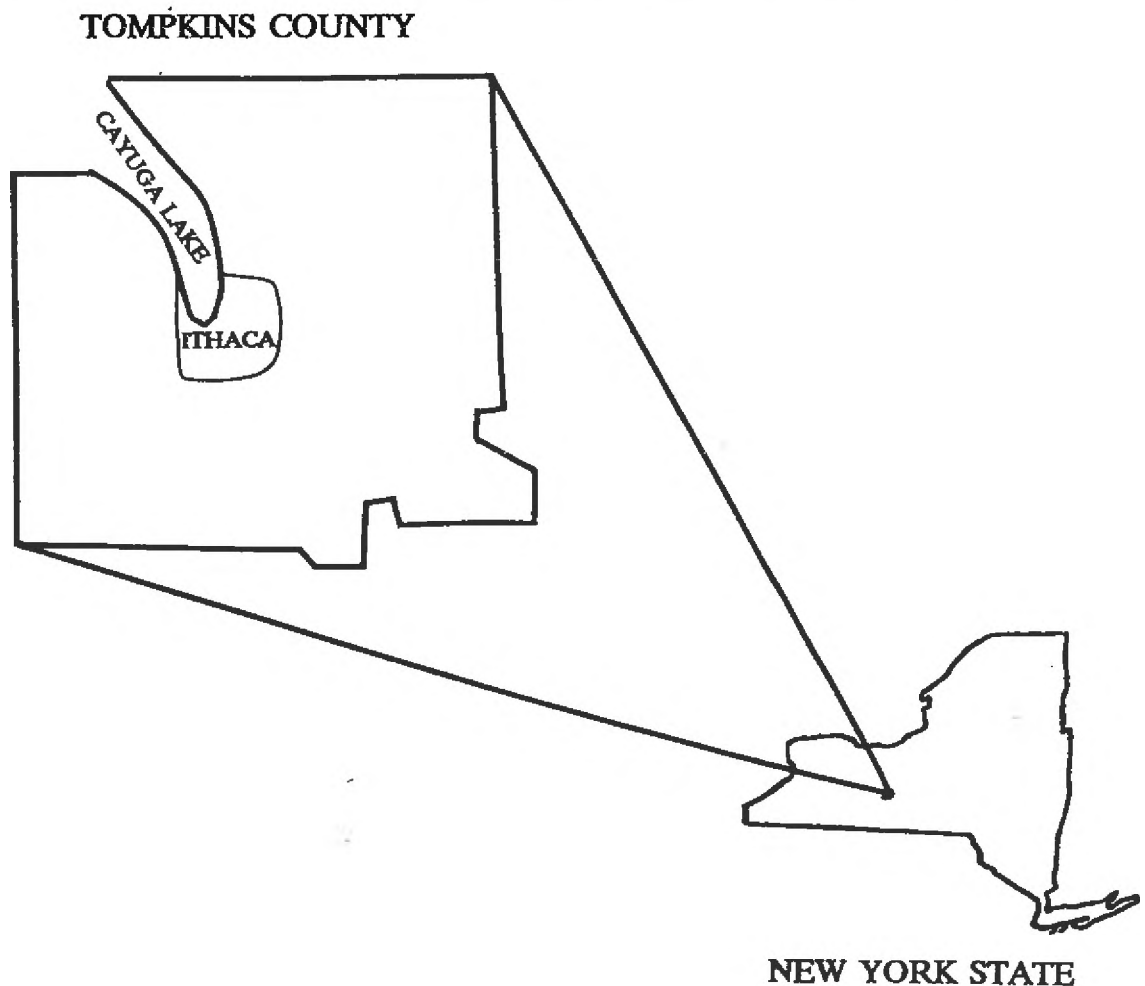


Figure 1. Map of Tompkins County, NY study area.

throughout the county, including downtown Ithaca (described below), and DRVAs have occurred within Ithaca city limits (personal observation of the senior author). The deer population in the county supports substantial recreational hunting activity. In 1988, the legal deer harvest for Tompkins County was 4,301 (3.4 deer/km² [8.7 deer/mi²]), including 1,736 adult bucks and 2,565 antlerless deer. This level of deer harvest was typical for the previous several years, as well.

Tompkins County had a human population of 87,085 in 1980 (Bureau of the Census 1982), with 1 urban center, the City of Ithaca (population 28,732). The population of the county decreases by approximately 15,000 when Cornell University and Ithaca College are not in regular session, from mid December through late January, then again from mid May through late August. Approximately 55,000 noncommercial motor vehicles were registered in Tompkins County in 1988. The county (excluding Ithaca) has approximately 158 miles of state-owned highway, and 993 miles of local roads (NYSDOT 1988).

METHODS

Two principal data-collection methods were employed in this pilot study: records kept by cooperating insurance agents in Tompkins County, NY and a telephone survey of county residents. These methods are described below.

Cooperating Insurance Agents

Cooperation was sought from 13 of the largest insurance agencies in Tompkins County, NY; all agreed to participate. The cooperators collected data on DRVA

claims filed with them during the 3-month period 1 Oct.-31 Dec. 1988. This period was selected for 2 reasons. First, we anticipated that it would be impractical to obtain cooperation for an entire year because a separate set of records would have to be kept for our specific purposes, thereby placing additional burdens on the cooperators' staffs. (Normally, the fact that a deer was the cause of an accident was not recorded for insurance record purposes.) Second, an analysis of DEC records of carcass-possession tags issued for car-killed deer for the 7-year period preceding the study indicated that consistently about 2/3 of the annual tags were issued during the last quarter of the year (Fig. 2). Thus, by concentrating our sampling effort during 1 Oct.-31 Dec. we

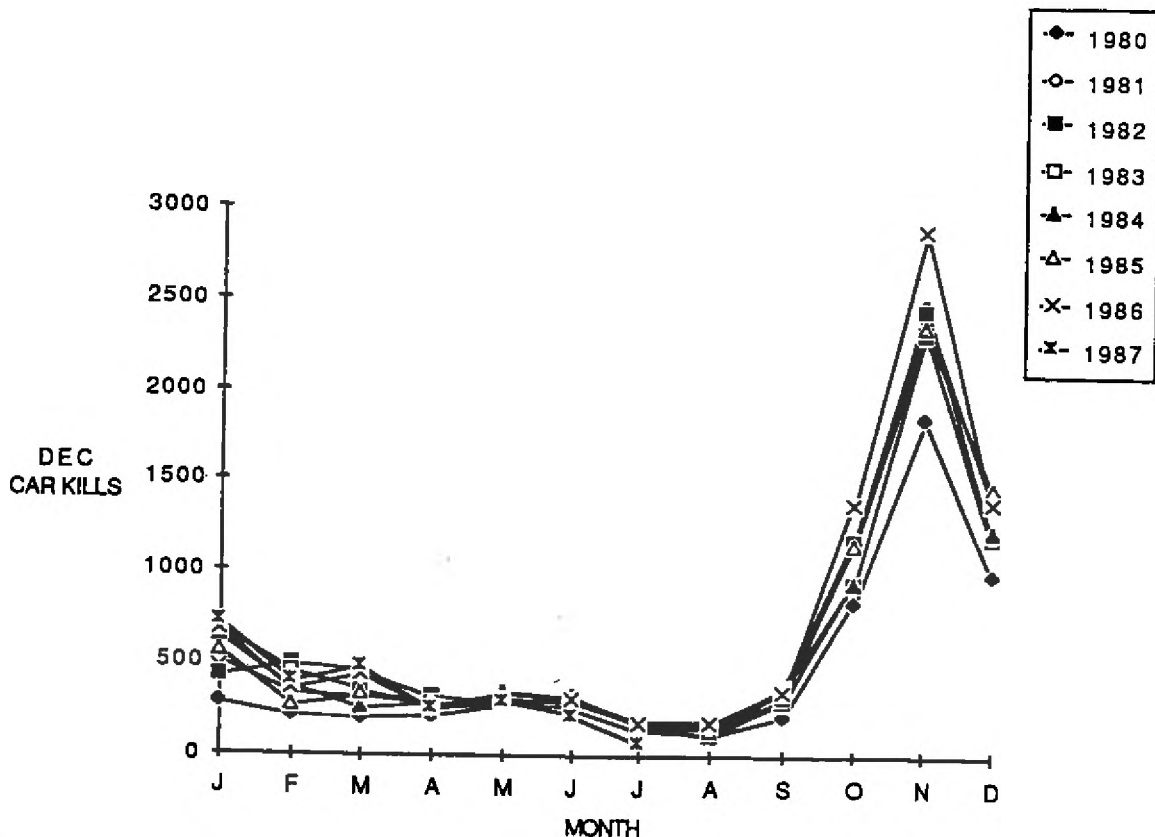


Figure 2. New York State Department of Environmental Conservation record of deer-car kills by month for 1980-1987.

could increase the chances for cooperation by insurance agents initially and for the full sampling period, and still obtain 2/3 of a year's data. We could not identify any reason for the costs of accidents to differ relative to the time of year they occur.

Cooperating insurance agents (cooperators) were issued data sheets (Appendix A), which were designed with input from each cooperator to tabulate the following information: date of accident; time of accident; location of accident (town and road); county of residency of insured; insured's license number and state; number of vehicles involved; whether a deer was actually struck; cost of property damage (minus deductibles) by policy type; total of deductibles paid by insured; number of people requiring medical attention; and whether a human death resulted. Data were recorded only for those accidents occurring in Tompkins County and involving Tompkins County residents.

A member of the study team delivered the data forms in person in late September 1988 and answered questions about them. Each cooperator was telephoned several times during the study period to ensure that the data were being collected and to answer questions that may have arisen. The data forms were collected in person by a member of the study team once or twice during the 3-month period. Outstanding forms were collected in early February 1989. At that time 2 cooperators were unable to supply the needed data because of idiosyncracies in their computer-based, centralized

data collection systems, and 1 other cooperator was unable to provide data due to a large turnover in office staff.

Telephone survey

A random start, systematically-drawn sample of 800 names and telephone numbers was selected from the New York Telephone directory for Tompkins County, NY. Our intent was to reach 450 to 500 resident households in the county. Telephone interviews were conducted with adult (16 years of age or older) members of households during January 1989. Interviewees were requested to provide information on (1) county of residence (to ensure sample integrity), (2) number of motor vehicles registered in Tompkins County, (3) DRVA experience, and (4) if a household member had experienced a DRVA during 1988, detailed information on cost, personal injury, and accident reporting behavior.

The primary objective of the telephone survey was to identify the incidence and costs of unreported DRVAs (i.e., DRVAs not reported to insurance agents participating in our study). Because we anticipated the percentage of interviewees who experienced a DRVA in 1988 to be low, we also asked the randomly selected interviewees if they knew anyone outside their household who had experienced a DRVA during 1988. In this way we used the original contacts as informants to lead us to other people with DRVAs. Although these additional people could not be used in any frequency tabulations because of the way in which they were identified, the information they supplied could be included in our estimates of average cost per DRVA. Information

about the character of DRVAs these people could provide also would be useful. Thus, the people identified by the original interviewees were subsequently contacted. Responses of this group were used only in estimating the costs of unreported DRVAs.

RESULTS

Cooperating Insurance Agents

Cooperators received claims for 90 DRVAs during the 3-month sampling period (1 Oct.-31 Dec. 1988), 82 of which had been settled in time for this analysis. Insights about seasonality of DRVAs are not available from these data because of the limited sampling period used, but time of day was recorded; 63% of the reported DRVAs occurred between 1700 and 2400h. All the DRVAs reported involved only 1 vehicle, and in all but 3 (i.e., 97%) a deer was struck by the vehicle. Five DRVAs (6%) resulted in personal injury to 1 or more individuals in the vehicle; 3 of these required medical attention, but none were fatal.

Damage costs of the DRVAs reported to cooperating insurance agents, including the value of deductibles, averaged \$1,415 (range \$191-\$5,050). The total damage costs for the claims made to cooperating insurance agents during the sample period was \$116,042. The costs incurred by claimants as a result of their deductibles ranged from \$0-\$500. Claims paid by insurance companies (i.e., cost of damage minus deductible) averaged \$1,266 (range \$0-\$5,000).

Telephone Interviews of County Residents

Telephone interviews were completed with members of 471 resident households in Tompkins County. An attempt was made to reach all 800 people originally selected, but telephoning was stopped on the evening when we had achieved our goal of over 450 successfully completed interviews. Thus, all people selected were called once, but might not have been subject to a repeat call if not at home the first time.

Interviewees reported a mean of 1.9 registered vehicles per household. Most interviewees (65.8%) were male. Overall, 31.0% reported personal involvement in a DRVA sometime in the past; 28.9% had been in a DRVA in New York State; 24.8% had been involved in a DRVA in Tompkins County during their residence in the county, which averaged 20.1 years (range 1-86 years). In 1988 specifically, 3.0% of interviewees had been involved in a DRVA in Tompkins County. Nearly as many (2.8%) reported that another member of their household had been involved in a separate DRVA in the county in 1988. Among the households sampled, 27 DRVAs occurred during 1988.

Most DRVAs (63%) reported by telephone interviewees occurred during the last 3 months of 1988 (identical to DEC deer/car collision records based on carcass-possession tag issuance which had a 7-year [1980-1986] average of 63% [DEC unpubl. data]). Over half the DRVAs occurred between 1700 and 2400h. In all but 1 DRVA a deer was struck by the vehicle, and in all cases only 1 vehicle was involved. Police were notified about 14 of the DRVAs, but DEC was contacted in only 1 case. No

human injuries were reported for the 27 cases. Less than half (41%) of the DRVAs were reported to insurance companies; we did not ask why people did not file claims, but some people reported that they wanted to avoid insurance rate increases.

Telephone interviewees reported 10 DRVAs for which claims were filed with insurance companies and they were confident they could recall cost estimates (1 individual was not able to provide cost data). The average of these cost estimates was \$912 (range \$250-\$2,000), less than the average amount from the sample of actual claims records kept by cooperating insurance agents.

Telephone interviewees reported 16 DRVAs in which they or a member of their household had been involved but for which claims had not been filed with insurance companies during 1988 (in only 14 cases were cost estimates available). Interviewees also identified people outside their households who they believed had experienced a DRVA in 1988. When these additional people were subsequently contacted, 12 were found to have had an unreported DRVA during 1988. The estimated costs of the 26 unreported DRVAs we identified from all the interviews (i.e., the randomly selected people plus the additional people identified by them) averaged \$523 (range \$0-\$5,000).

IMPLICATIONS

The implications to be drawn from the pilot study are of 2 general types--the actual incidence and costs of DRVAs in Tompkins County and estimates for all New York State, and implications of this information for deer population management within any geographic area. The first set of implications needs to be explored to provide

context for the second. The first set requires extrapolation of the pilot study data, some parts of which are tenuous. We do this because of the paucity of information on the incidence and costs of DRVAs; the exercise may prove useful in drawing attention to the consideration of DRVAs in deer management.

Alternative approaches can be taken to estimate the actual number of DRVAs that occurred in Tompkins County. We use one that is based on extrapolations from the household survey and the estimated number of resident households in Tompkins County in 1988 (30,200). In this method the proportion of households reporting a DRVA in our sample is simply expanded to the entire population of resident households in the county. The telephone survey indicated that 2.3% ($\pm 1.1\%$ at 90% confidence) of Tompkins County households had reported DRVAs to insurance agents; thus, the estimated number of reported DRVAs for 1988 would be $30,200 \times 2.3\% = 695$ (± 332). The survey indicated that 3.4% ($\pm 1.4\%$ at 90% confidence) of Tompkins County households had an unreported DRVA in 1988; thus, the estimated number of unreported DRVAs would be $30,200 \times 3.4\% = 1,027$ (± 423). An overall estimate of 1,722 (± 532) reported and unreported DRVAs was calculated for Tompkins County in 1988. The 90% confidence interval of 1,190 to 2,254 DRVAs is wide, but the revealing aspect of the estimate is its general magnitude. The overall, county-wide rate of DRVAs was 1 per km (1.6/mile) of highway or 1.3 per km² (3.4/mi²), but the DRVAs were not evenly distributed throughout the county.

The cost of DRVAs in Tompkins County during 1988 can be estimated simply by using the average costs for reported and unreported accidents and multiplying by the respective estimates of the number of each type. Thus, the average cost of a reported DRVA (\$1,415 according to cooperators) times the estimated number of such accidents (695) results in a cost estimate of \$983,425. The average cost of an unreported DRVA (\$523 according to people who have incurred such accidents) times the estimated number of such accidents (1,027) results in a cost estimate of \$537,121. The sum of these 2 estimates gives a gross estimate of \$1.5 million for the total cost of DRVAs in Tompkins County for 1988.

Although there are several potential sources of error in these calculations, there are also several aspects to our approach that could lead to the conclusion that they result in a conservative estimate of DRVAs in the county. First, buses, motorcycles, large trucks, and other commercial and government vehicles are not considered in the pilot study. The number and incidence of DRVAs involving these kinds of motor vehicles were not included. Second, the DRVAs involving out-of-county vehicles of any type are not incorporated in the estimates. Third, most students residing in the county for only the school year are not included; this involves several thousand motor vehicles for 8 months of the year.

Assuming Tompkins was typical of other New York State counties, how many DRVAs might have occurred statewide in 1988 and what might the cost have been? A first approximation of these numbers can be obtained by using the proportion of car-

killed deer carcass tags for Tompkins County. DEC issued approximately 9,500 carcass-possession tags resulting from deer/car collisions in 1988; 250 of the tags were issued in Tompkins County, which is about 15% of our estimate of DRVAs for the county. Thus, for every carcass permit issued, perhaps 6 accidents occurred. Assuming the Tompkins County situation to be representative, the 9,500 tags issued statewide would actually represent approximately 57,000 DRVAs in New York during 1988. A conservative estimate of the cost of damage to vehicles would be in the range of \$50 million.

Admittedly, the statewide DRVA incidence and cost estimates are tenuous, but they shed some light on the potentially large economic impact of deer on a large group of stakeholders in deer population management—motorists. This insight is useful regardless of the state or region being considered.

When considering the potential recreational benefits of higher deer populations, managers must also keep in mind the costs associated with such populations. Information obtained in this pilot study can be used by wildlife managers as a substantial argument in support of deer management that involves deer harvests and limiting the size of deer populations in geographic areas where DRVAs are believed to be increasing or too high.

FUTURE RESEARCH

Two additional efforts are planned as the next phases of this study. First, we intend to collect attitudinal data from Tompkins County resident motorists to determine

their acceptance capacity for deer. We will obtain information on perceptions of deer abundance and risk of DRVAs, enjoyment of deer, and preference for deer population trends. These data will be correlated with the DRVA history of individuals and deer population density estimates. Second, we intend to collaborate with the DEC to expand this work to represent more accurately the statewide situation. Using deer harvest data and a deer population reconstruction model developed at Cornell University, together with data on highway and traffic characteristics, we will categorize geographic areas (e.g., counties or Deer Management Units) of the state having similar levels of traffic and deer densities, then replicate the study of the incidence and costs of DRVAs and the attitudinal survey of resident motorists in a sample of geographic areas from each category. Then, depending on the outcome, we will seek a method to monitor the statewide situation annually, with an eye toward establishing wildlife acceptance capacity indices for motorists relative to deer.

Perhaps once acceptance levels are identified, managers will have a gauge with which to identify areas with "too many" DRVAs. This could lead to a refinement of white-tailed deer management and reflect broader societal concerns for such management.

LITERATURE CITED

- Allen, R. E., and D. R. McCullough. 1976. Deer-car accidents in southern Michigan. *J. Wildl. Manage.* 40:317-325.
- Arnold, D. A. 1978. Characteristics and costs of highway deer kills. Pages 92-101 in *Wildlife and people*. C. M. Kirkpatrick, ed. Proc. 1978 John S. Wright Forestry Conf. Purdue Univ., West Lafayette, Ind.
- _____. 1979. Deer on the highway. *Traffic Safety* 79(5):8-10.
- Bellis, E. D., and H. B. Graves. 1971. Deer mortality on a Pennsylvania interstate highway. *J. Wildl. Manage.* 35:232-237.
- Brown, T. L., and D. J. Decker. 1979. Incorporating farmers' attitudes into management of white-tailed deer in New York. *J. Wildl. Manage.* 43:236-239.
- _____, _____, and C. P. Dawson. 1978. Willingness of New York farmers to incur white-tailed deer damage. *Wildl. Soc. Bull.* 6:235-239.
- Bureau of the Census. 1982. General population characteristics, part 34, New York. U.S. Gov. Printing Office, Washington, D.C.
- Carbaugh, B., J. P. Vaughan, E. D. Bellis, and H. B. Graves. 1975. Distribution and activity of white-tailed deer along an interstate highway. *J. Wildl. Manage.* 39:570-581.
- Connelly, N. A., D. J. Decker, and S. Wear. 1988. Public tolerance of deer in a suburban environment: implications for management and control. In N. R. Holler, ed. *Proc. East. Wildl. Damage Control Conf.* 3:207-218. Gulf Shores, Ala.
- Decker, D. J., and T. L. Brown. 1982. Fruit growers' vs. other farmers: attitudes toward deer in New York. *Wildl. Soc. Bull.* 10:150-155.
- _____, and N. A. Connelly. 1988. Hunters' assessment of the deer management permit system in New York State. Human Dimensions Res. Unit Publ. 88-8. Dept. Nat. Resour., N.Y.S. Coll. of Ag. and Life Sci., Cornell Univ., Ithaca, N.Y. 27pp.
- _____, and T. A. Gavin. 1987. Public attitudes toward a suburban deer herd. *Wildl. Soc. Bull.* 15:173-180.

- _____, and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. *Wildl. Soc. Bull.* 16:53-57.
- _____, N. Sanyal, T. L. Brown, R. A. Smolka, Jr., and N. A. Connelly. 1984. Reanalysis of farmer willingness to tolerate deer damage in western New York. In D. J. Decker, ed. *Proc. East. Wildl. Damage Control Conf.* 1:37-45. Cornell Coop. Ext., Ithaca, N.Y.
- _____, R. A. Smolka, Jr., N. Sanyal, and T. L. Brown. 1983. Hunter reaction to a proposed deer management initiative in northern New York: antecedents to support or opposition. *Trans. Northeast Sect. Wildl. Soc.* 40:76-93.
- Dickinson, N. R. 1983. Physiographic zones of southern and western New York. F-W-P245, New York State Dept. of Environmental Conservation, Division of Fish and Wildlife, Albany, N.Y. 11pp.
- Feldhamer, G. A., J. E. Gates, D. M. Harman, A. J. Loranger, and K. R. Dixon. 1986. Effects of interstate fencing on white-tailed deer activity. *J. Wildl. Manage.* 50:497-503.
- Gilbert, J. R. 1982. Evaluation of deer mirrors for reducing deer-vehicle accidents. Fed. Highway Admin. Rep. FHWA/RD-82/061. 12pp.
- Goetz, E. J., and R. T. Butterfield. 1978. Deer mortalities on a West Virginia interstate highway. *Trans. Northeast Sect. Wildl. Soc.* 35:154-164.
- Gutos, W. J. 1987. Highway deernomics 1986. Michigan Dept. Nat. Resour. Safety Div. memo, Lansing. 9pp.
- Hansen, C. S. 1983. Costs of deer-vehicle accidents in Michigan. *Wildl. Soc. Bull.* 11:161-164.
- _____, and A. C. Wolfe. 1983. Costs of deer-related automotive accidents. *Univ. Mich. Transp. Res. Rev.* 14(1):9-12.
- Langenau, E. E., and M. L. Rabe, eds. 1987. Deer-vehicle accidents in Michigan: a task force report. Michigan Dept. Nat. Resour. Wildl. Div. Rep. No. 3072. Lansing.
- Ludwig, J., and T. Bremicker. 1983. Evaluation of 2.4 m fences and one-way gates for reducing deer-vehicle collisions in Minnesota. *Transp. Res. Rec.* 913:19-22.

- National Safety Council. 1984. Warning: animal/vehicle crossing. Natl. Safety News 130:60.
- New York State Department of Transportation. 1988. 1987 highway mileage report for New York State. Transportation Statistics and Analysis Section, Data Services Bureau, Planning Div., NYSDOT. Albany, N.Y.
- Pennsylvania Game Commission. 1985. 1984 recorded highway mortality: deer and bear. Penn. Game News (Jun.):40.
- Pils, C. M., and M. A. Martin. 1979. The cost and chronology of Wisconsin deer-vehicle collisions. Wisconsin Dept. Nat. Resour. Res. Rep. 103. Madison, Wisc.
- Puglisi, M. J., J. S. Lindzey, and E. D. Bellis. 1974. Factors associated with highway mortality of white-tailed deer. J. Wildl. Manage. 38:799-807.
- Purdy, K. G., T. L. Brown, D. J. Decker, and J. W. Enck. 1989. Deer management in New York's Hudson Valley Region: an assessment of the interests and opinions of three key constituencies. Human Dimensions Res. Unit Publ. 89-1. Dept. Nat. Resour., N.Y.S. Coll. of Ag. and Life Sci., Cornell Univ., Ithaca, N.Y. 29pp.
- Reed, D. F., T. D. Beck, and T. N. Woodard. 1982. Methods of reducing deer-vehicle accidents: benefit-cost analysis. Wildl. Soc. Bull. 10:349-354.
- Reilly, R. E., and H. E. Green. 1974. Deer mortality on a Michigan interstate highway. J. Wildl. Manage. 38:16-19.
- Rudelstorfer, K., and K. Schwab. 1975. Optical devices for traffic safety. Univ. Innsbruck, Schriftenreihe, Austria. No. 4.
- Sayre, R. W., and D. J. Decker. 1989. Extent and nature of deer damage to commercial nurseries in New York. Proc. East. Wildl. Damage Control Conf. 4:162-172. Madison, Wisc.
- Schafer, J. A., and S. T. Penland. 1985. Effectiveness of Swareflex reflectors in reducing deer-vehicle collisions. J. Wildl. Manage. 49:774-776.
- Smolka, R. A., Jr., G. A. Pomerantz, and D. J. Decker. 1986. Importance of deer to resident and nonresident recreational experiences in northern New York. Human Dimensions Res. Unit Publ. 86-3. Dept. Nat. Resour., N.Y.S. Coll. of Ag. and Life Sci., Cornell Univ., Ithaca, N.Y. 152pp.
- Williams, J. E. 1964. Deer, death and destruction. Colo. Outdoors 13(2):1-3.

Wood, P., and M. L. Wolfe. 1988. Intercept feeding as a means of reducing deer-vehicle collisions. Wildl. Soc. Bull. 16:376-380.

Zacks, J. L. 1986. Do white-tailed deer avoid red?: an evaluation of the premise underlying the design of Swareflex wildlife reflectors. Transp. Res. Rec. 1075:35-43.

DEER-RELATED VEHICULAR ACCIDENT (DRVA) FORM

Page _____

Question

DRVA #1

DRVA #2

DRVA #3

Question	Mo./Day	Mo./Day	Mo./Day
1. Date of accident			
2. Time of accident	am pm	am pm	am pm
3. Location of accident Town Road/Highway/Street, etc.			
4. Does insured reside in Tompkins County?	Y N	Y N	Y N
5. Insured's license plate number and state	No.	No.	No.
6. Was DRVA single or multiple vehicle accident?	State single multiple	State single multiple	State single multiple
7. Was a deer actually hit?	Y N	Y N	Y N
8a. Estimated cost (minus deductibles) of property damage claimed under the following types of policies?	a) Comp.\$ _____ b) Coll.\$ _____ c) Liab.\$ _____	a) Comp.\$ _____ b) Coll.\$ _____ c) Liab.\$ _____	a) Comp.\$ _____ b) Coll.\$ _____ c) Liab.\$ _____
8b. Total of the deductible(s) paid by insured from this DRVA?	\$ _____	\$ _____	\$ _____
9. Did DRVA cause injuries requiring medical attention to driver or passengers? If so, how many people needed medical attention?	Y N # _____	Y N # _____	Y N # _____
10. Did DRVA result in death of the driver or passengers? If so, how many people?	Y N # _____	Y N # _____	Y N # _____
Comments or explanatory information:			